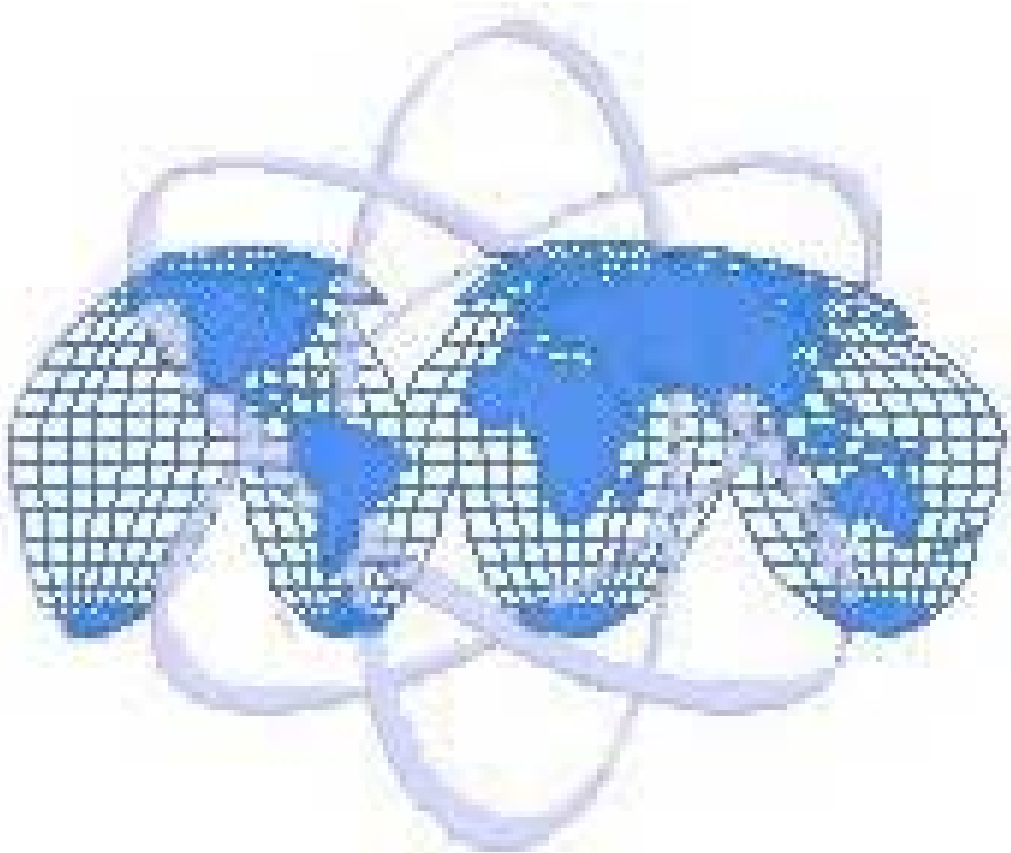


Ron Lehman
Welcome to Saclay

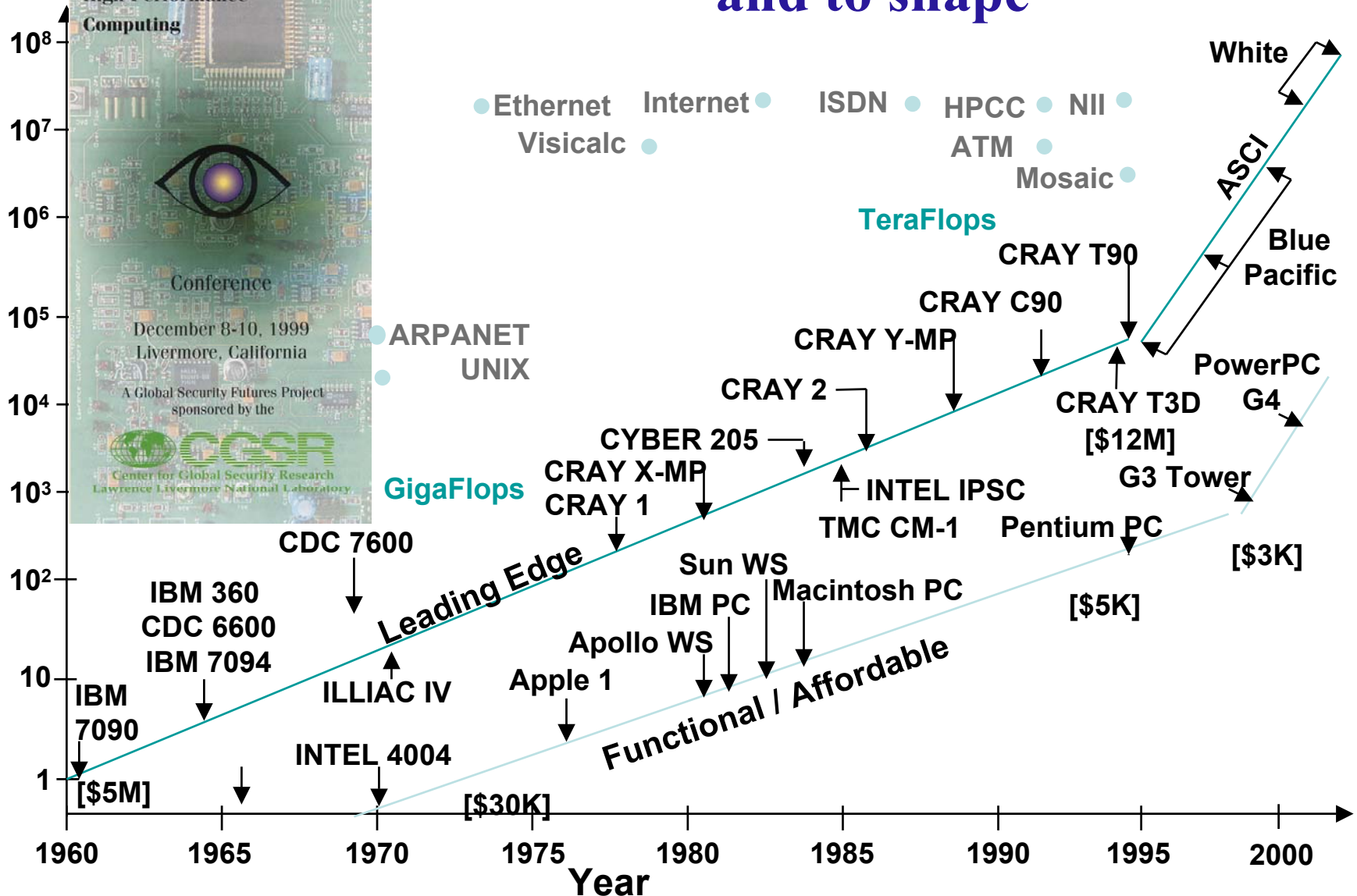
**The 2003 Futures Project of
the Center for Global Security Research
Lawrence Livermore National Laboratory**



**“ATOMS FOR
PEACE”
AFTER FIFTY
YEARS:
The New
Challenges and
Opportunities**

“Brainstorming about the Future, Less to predict than to understand and to shape”

Million Operations per Second



Seek Clarity, not Consensus



The fundamental forces shaping the future:
What do we know? What don't we know?
What most do we need to find out?

“Atoms for Peace”

President Dwight David Eisenhower

470th Plenary of the UN General Assembly

Tuesday, 8 December 1953, 2:45 pm EST

Report on Bermuda Summit with UK and France



“... the knowledge now possessed by several nations will eventually be shared ...”

.....

“... even a vast superiority in numbers of weapons, and a consequent capability of devastating retaliation, is no preventive ...”

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“The United States ... is instantly prepared to meet privately with such other countries as may be ‘principally involved,’ to seek ‘an acceptable solution’ to the atomic armaments race ...”

.....

“... make joint contributions from their stockpiles of normal uranium and fissionable materials to an international atomic energy agency.”

.....

“The more important responsibility of this atomic energy agency would be to devise methods whereby this fissionable material would be allocated to serve the peaceful pursuits of mankind. Experts would be mobilized to apply atomic energy to the needs of agriculture, medicine and other peaceful activities. A special purpose would be to provide abundant electrical energy in the power-starved areas of the world .”

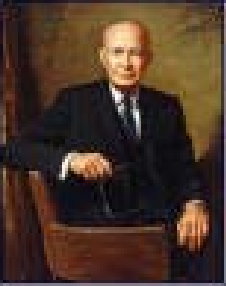


The Big Question:

**WHERE
ARE
THINGS
NUCLEAR
HEADED
NOW?**

The bumper stickers?
The one-liners?
The elevator speeches?
The one-pagers?
The executive summary?
The dissertations?

AfP50/50



**ATOMS FOR PEACE
AFTER FIFTY YEARS:
The New Challenges
And
Opportunities**



Can we understand and integrate these?

➤ INTERNATIONAL SECURITY

➤ **Defense**

➤ **Proliferation**

➤ CIVILIAN APPLICATIONS

➤ **Power**

➤ **Medical and other Peaceful Applications**

➤ CROSS-CUTTING ISSUES

➤ **Materials and Waste**

➤ **Governance**

➤ **Evaluating and Communicating**

Benefits and Risk



Trends and/or Dynamics in Technology and Context: What have we Learned? Where are we Headed?



1953

2003

< 2053

Defense

Thermonuclear
Sword of Damocles;
Bi-polar Balancer

Deep Reductions;
Weapons of Last Resort;
Counter WMD

Regional Competition?;
Multi-polar deterrence?
Super-terrorism?
Abolition?

Proliferation

Only 3 nuclear powers,
each a permanent
member of UN Security
Council

188 NPT Parties; DPRK;
9 nuclear states w/ half of
world's population;
4 rollback states.

Universal Latency?
Sub- and trans- national
actors?
Irrelevant?

Power

Developing nuclear
submarines

Some 500 power reactors,
but growth diminishing

Legacy systems v. New
designs & growth?

Applications

1st Generation Image
Intensifiers spread real
time X-ray imaging

Digital & Genetic
revolutions re-energize
Nuclear Diagnostics

Individualized medicine?
Nano-imaging?
Taboo?

Materials

Shortage for military
and civilian use

Huge civilian and military
overhang; Waste bottleneck

Regional Repositories?
Waste Minimalization?
Transmutation? Paralysis?

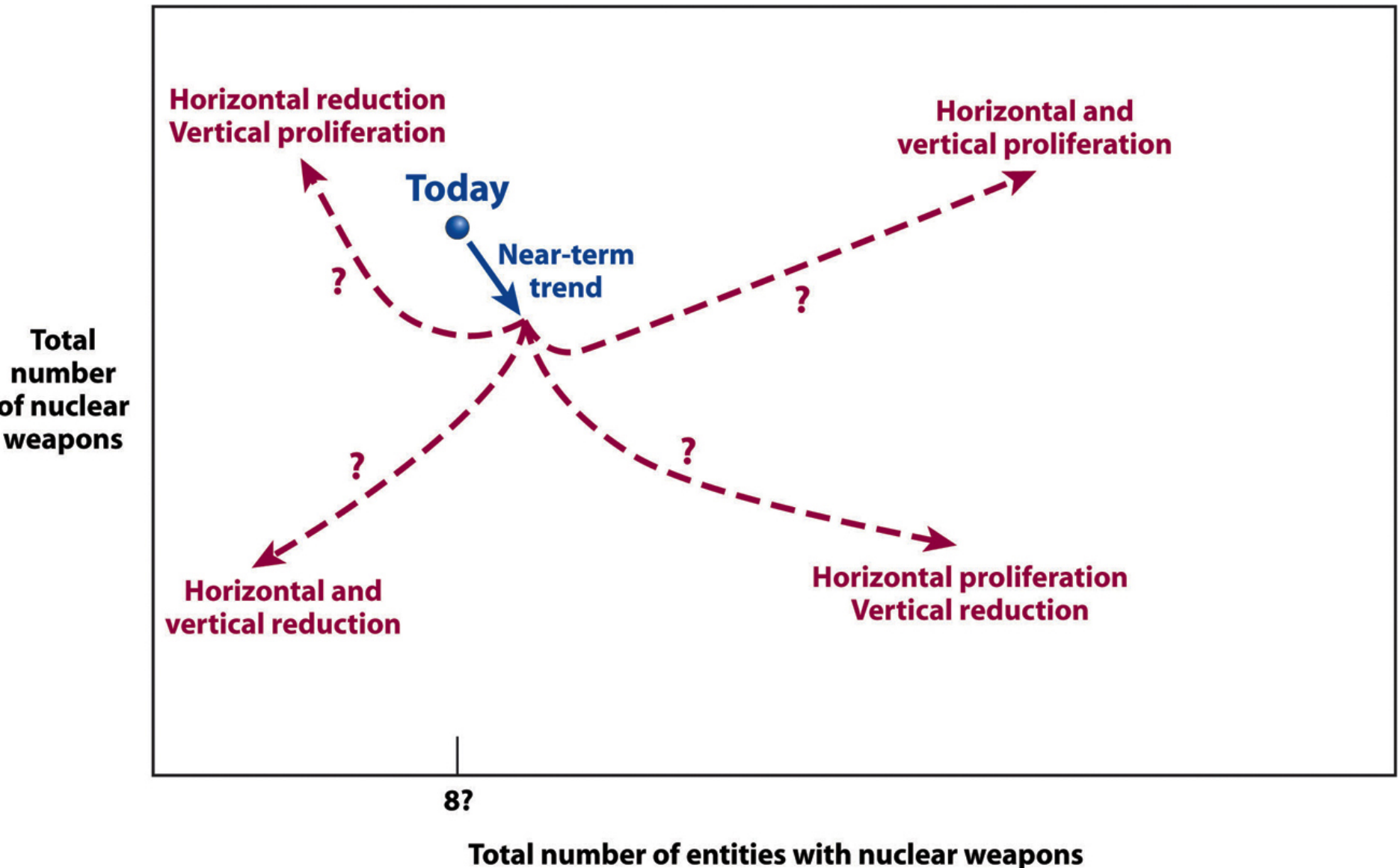
Governance,
Benefits &
Risk

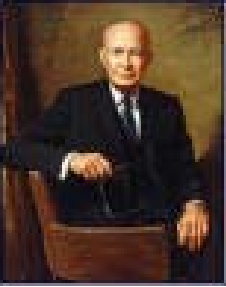
Cold War outweighs
environmental impact;
Atomic Energy Act

Environmental Zero
Tolerance; NIMBY; IAEA;
UNSC veto threat

Universal Norms v. Like-
minded Core v. Spheres of
Influence? Pre-negotiated
rules for Risk Analysis?

Where are Nuclear Forces and Proliferation Headed?

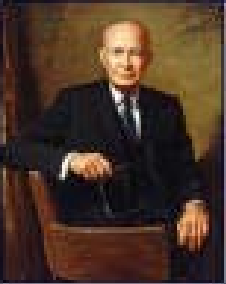




Straw Man: **Alternative Nuclear Futures?** **Bulls, Bears, or Index Funds?**

Will nuclear security issues be

- **More Significant?**
 - **WMD Proliferation and Latency?**
 - **Asymmetric Response**
 - **Multi-polar Spheres of Influence?**
 - **Nth World Rivalry and Use?**
 - **Weapons of Alienation?**
- **About the Same?**
 - **Legacy systems and platforms?**
 - **Pace of dismantlement?**
 - **Evolutionary political change?**
- **Less Significant?**
 - **Advanced Conventional Munitions?**
 - **End of Superpower Face-off?**
 - **Deep Reductions?**
 - **Globalization?**

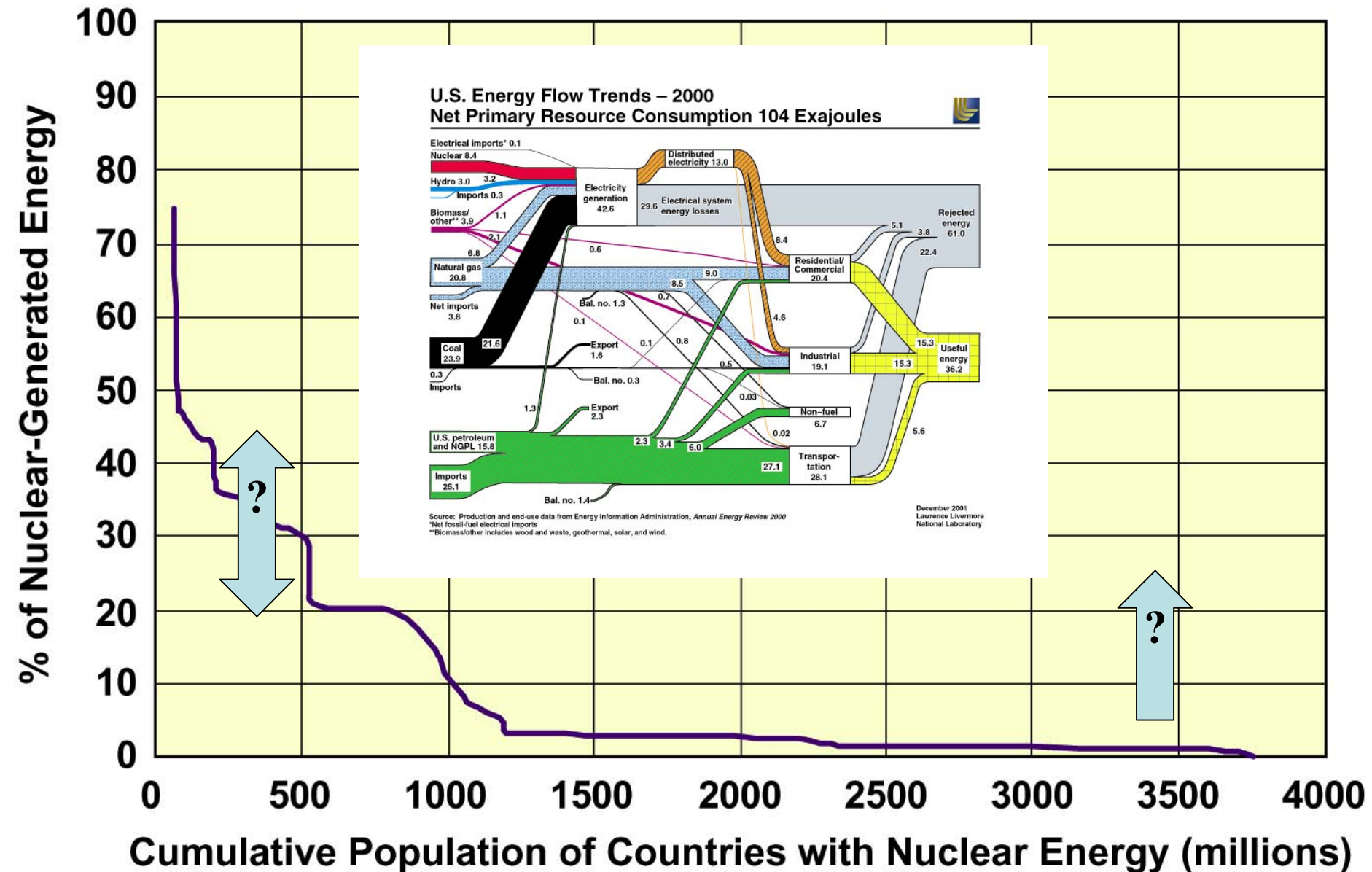


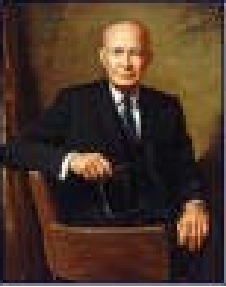
Straw Man Factors (continued)

Will nonproliferation accomplishments be

- **More Significant?**
 - 188 of 194 Parties to NPT?
 - Iraq and or other rollback?
 - NP support regimes (NSG, MTCR, etc)?
 - Rise of economic interests?
- **About the Same?**
 - Already most people in countries that have nukes?
 - Latent capabilities now long standing?
 - Few additional countries seek capability?
 - Very few WMD Rogues?
- **Less Significant?**
 - Technology and Talent Spread?
 - Super-terrorism and Fundamentalism?
 - Conflicts of political and economic interests?
 - Loose Nukes and Material?
 - Unraveling of NPT norms and/or enforcement?
 - Wassenaar weaker than COCOM?
 - DPRK? Failed Nuclear States?
 - Non-roguers follow Indian Model?

Will the Intensity and Quantity Increase or Decrease?

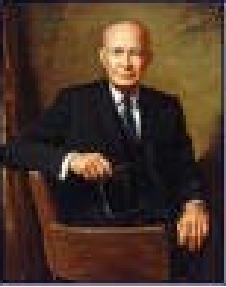




Straw Man Factors:

Will nuclear power be

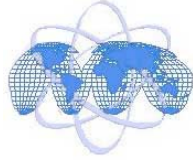
- **More Significant?**
 - **Advanced Reactor Designs?**
 - **Proliferation-resistance enhancements?**
 - **Hydrogen Economy?**
 - **Climate Change?**
 - **New Governance and Risk Mitigation?**
 - **Yucca Mountain and Regional Repositories?**
- **About the Same?**
 - **Legacy Reactors, Waste, and Materials?**
 - **Long Lead times for Reactors?**
 - **Longer Lead times for Waste Disposal?**
 - **Persistence of Proliferators?**
 - **Permanent Bureaucracy?**
- **Less Significant?**
 - **Vulnerability to terrorism?**
 - **Globalization of NIMBY?**
 - **Rise of Renewable Energy Sources?**
 - **Tight EIS and health standards?**
 - **Opportunity Cost for Capital?**



Straw Man Factors (continued)

Will non-power nuclear technology be

- **More Significant?**
 - Reduced dose, precise applications?
 - Higher contrast imaging?
 - Digital databases and networked experts?
 - Artificial Intelligence adjuncts?
 - Hormesis?
- **About the Same?**
 - Sunk equipment costs with expensive alternatives?
 - Waste disposal bottleneck?
 - Established protocols, regulatory inertia?
- **Less Significant?**
 - Alternative non-nuclear imaging & diagnostics?
 - Genetic therapy and advanced biochemistry?
 - Tighter security on radioactive materials?
 - Improved modeling of materials and biological processes?



Alternative Nuclear Futures?

Significance from Security Perspective

More?

Same?

Less?

6	8	9
3	5	7
1	2	4

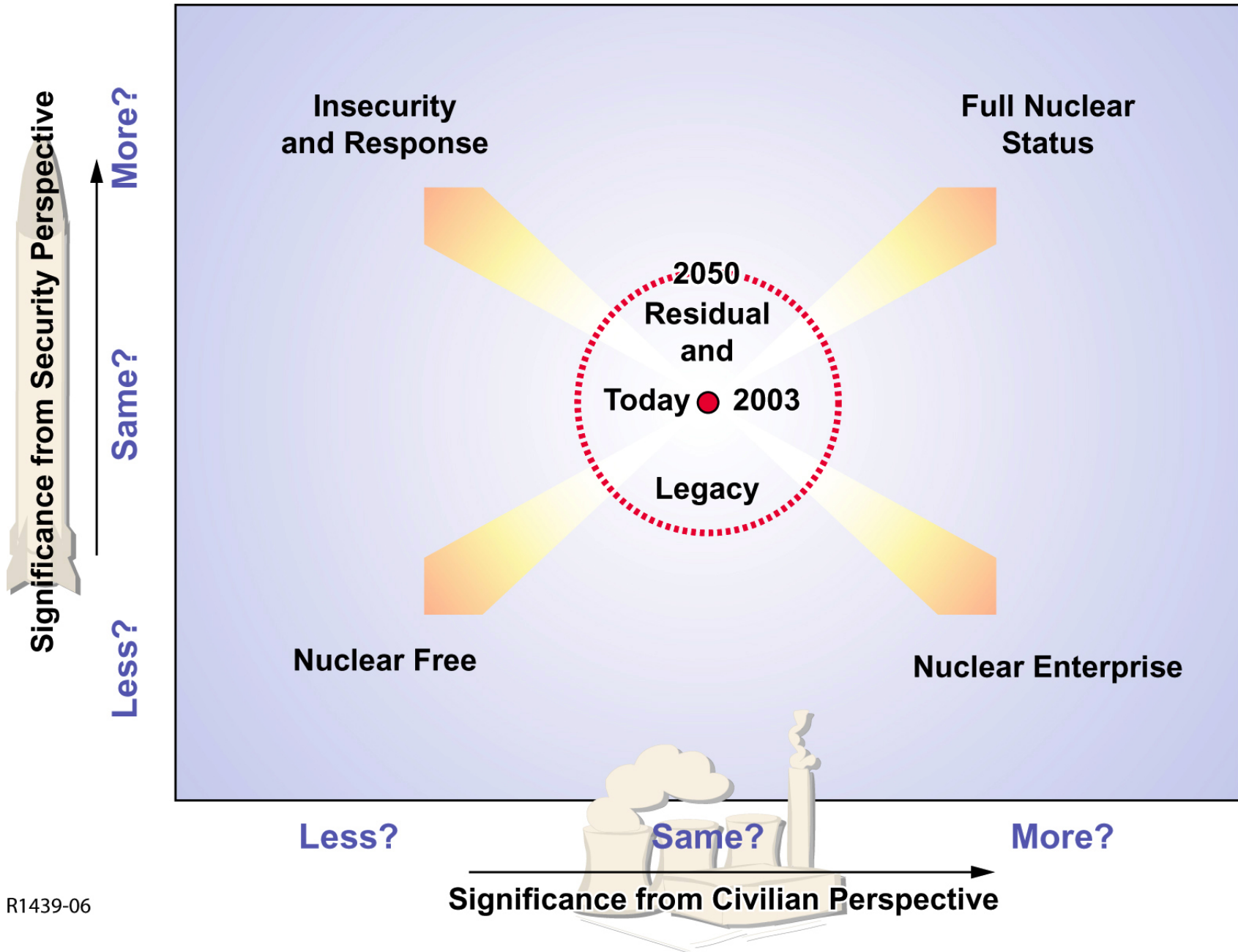
Less?

Same?

More?

Significance from Civilian Perspective?

Alternative Nuclear Futures





Perspectives:

Analytical: What Could Happen?

Probabilistic: What Will Likely Happen?

Predictive: What Will Happen?

Normative: What Should Happen?

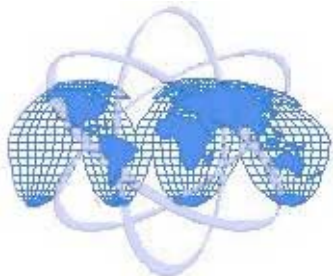
Insights:

Fundamental Forces (Agreed)?

Significant Uncertainties (Not Agreed)?

Transforming Events (May not Control)?

Leveraged Factors for Change (Might Control)?



Measures of Merit/Indicators of Success?

“Atoms for Peace”

President Dwight David Eisenhower

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Report on Bermuda Summit with UK and France



.....

**“Never before in history has so much hope for so many people
been gathered together in a single organization.”**

.....

**“Clearly, if the peoples of the world are to conduct an intelligent search for peace,
they must be armed with the significant facts of today’s existence.”**

.....

**“Atomic bombs today are more than twenty-five times as powerful as the weapon
with which the atomic age dawned, while the hydrogen weapons are in the ranges of
millions of tons of TNT equivalent.”**

.....

**“First, the knowledge now possessed by several nations will eventually be shared by others
possibly all others.”**

**Second, even a vast superiority in numbers of weapons, and a consequent capability
of devastating retaliation, is no preventive, of itself, against the fearful material damage
and toll of human lives that would be inflicted by surprise aggression.”**

.....

“Atoms for Peace”
President Dwight D. Eisenhower
8 December 1953



“I know that in a world divided, such as ours today, salvation cannot be attained by one dramatic act.”

.....

“On the contrary, we hope that this coming conference [Austria] may initiate a relationship with the Soviet Union which will eventually bring about a free intermingling of the peoples of the East and the West – the one sure, human way of developing the understanding required for confident and peaceful relations.”

.....

“The United States, heeding the suggestion of the General Assembly of the United Nations, is instantly prepared to meet privately with such other countries as may be ‘principally involved,’ to seek ‘an acceptable solution’ to the atomic armaments race which overshadows not only the peace, but the very life, of the world.”

.....

“The governments principally involved, to the extent permitted by elementary prudence, begin now and continue to make joint contributions from their stockpiles of normal uranium and fissionable materials to an international atomic energy agency.”

.....

“Atoms for Peace”
President Dwight D. Eisenhower
8 December 1953
.....



“Undoubtedly, initial and early contributions to this plan would be small in quantity. However, the proposal has the great virtue that it can be undertaken without the irritations and mutual suspicions incident to any attempt to set up a completely acceptable system of world-wide inspection and control.”
.....

“The atomic energy agency could be made responsible for the impounding, storage and protection of the contributed fissionable and other materials. The ingenuity of our scientists will provide special safe conditions under which such a bank of fissionable material can be made essentially immune to surprise seizure.”
.....

“The more important responsibility of this atomic energy agency would be to devise methods whereby this fissionable material would be allocated to serve the peaceful pursuits of mankind. Experts would be mobilized to apply atomic energy to the needs of agriculture, medicine and other peaceful activities. A special purpose would be to provide abundant electrical energy in the power-starved areas of the world .”
.....